



U.S. NUCLEAR REGULATORY COMMISSION

# STANDARD REVIEW PLAN

OFFICE OF NUCLEAR REACTOR REGULATION

## 2.3.1 REGIONAL CLIMATOLOGY

### REVIEW RESPONSIBILITIES

Primary - Accident Evaluation Branch (AEB) Probabilistic Safety Assessment Branch (SPSB)

Secondary - None

### I. AREAS OF REVIEW

For this section of the site safety assessment for an early site permit application, information is presented by the applicant and reviewed by the staff concerning averages and extremes of climatic conditions and regional meteorological phenomena which affect the safe design and siting of a nuclear power plant or plants of specified type that might be constructed on the proposed site the plant. The review covers the following specific areas:

1. A description of the general climate of the region with respect to types of air masses, synoptic features (high- and low-pressure systems and frontal systems), general airflow patterns (wind direction and speed), temperature and

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### USNRC STANDARD REVIEW PLAN

Standard review plans are prepared for the guidance of the Office of Nuclear Reactor Regulation staff responsible for the review of applications to construct and operate nuclear power plants. These documents are made available to the public as part of the Commission's policy to inform the nuclear industry and the general public of regulatory procedures and policies. Standard review plans are not substitutes for regulatory guides or the Commission's regulations and compliance with them is not required. The standard review plan sections are keyed to the Standard Format and Content of Safety Analysis Reports for Nuclear Power Plants. Not all sections of the Standard Format have a corresponding review plan.

Published standard review plans will be revised periodically, as appropriate, to accommodate comments and to reflect new information and experience.

Comments and suggestions for improvement will be considered and should be sent to the U.S. Nuclear Regulatory Commission, Office of Nuclear Reactor Regulation, Washington, D.C. 20555.

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humidity, precipitation (rain, snow, and sleet), and relationships between synoptic-scale atmospheric processes and local (site) meteorological conditions.

2. Seasonal and annual frequencies of severe weather phenomena, including tornadoes, waterspouts, thunderstorms, lightning, hail (including probable maximum size), and high air pollution potential.
3. Meteorological conditions used as design and operating bases, including:
  - a. The maximum snow and ice load (water equivalent) that the roofs of safety-related structures must be capable of withstanding during plant operation.
  - b. Ultimate heat sink meteorological conditions resulting in maximum evaporation and drift loss of water and minimum water cooling.
  - c. Tornado parameters, including translational speed, rotational speed, and the maximum pressure differential with the associated time interval.
  - d. 100-year return period "fastest mile of wind," including vertical velocity distribution and gust factor.
  - e. Probable maximum annual frequency of occurrence and time duration of freezing rain (ice storms) and, where applicable, dust (sand) storms.
  - f. Other meteorological and air quality conditions used for design and operating basis considerations.

## II. ACCEPTANCE CRITERIA

The information regarding the regional meteorological conditions and phenomena which **would** affect the safe design and siting of **the a nuclear power plant or plants of specified type that might be constructed at the proposed site** is acceptable if it meets the requirements of the following regulations:

- (1) 10 CFR Part 50, Appendix A, General Design Criterion 2 (GDC 2), "Design Bases for Protection Against Natural Phenomena" (Ref. 1), with respect to information on severe regional weather phenomena that have historically been reported for the region and that are reflected in the design bases for structures, systems, and components important to safety,
- (2) 10 CFR Part 50, Appendix A, General Design Criterion 4 (GDC 4). ~~"Environmental Missile Design Bases"~~ **"Environmental and Dynamic Effects Design Bases"** (Ref. 2), with respect to information on tornadoes that could generate missiles, and
- (3) 10 CFR Part 100, ~~\$100.10(c)~~ **20(c) and \$100.21(d)** (Ref. 3), with respect to the consideration that has been given to the regional meteorological characteristics of the site.

The information should be presented and substantiated in accordance with acceptable practice and data as promulgated by the National Oceanic and Atmospheric Administration (NOAA), industry standards, and regulatory guides.

Regulatory positions and specific criteria necessary to meet the Commission's regulations identified above are as follows:

1. The description of the general climate of the region should be based on standard climatic summaries compiled by NOAA (Refs. 4, 5). Consideration of the relationships between regional synoptic-scale atmospheric processes and local (site) meteorological conditions should be based on appropriate meteorological data (Refs. 5, 6).
2. Data on severe weather phenomena should be based on standard meteorological records from nearby representative National Weather Service (NWS), military, or other stations recognized as standard installations which have long periods on record. The applicability of these data to represent site conditions during the expected period of reactor operation must be substantiated (Refs. 5, 6, 7).

3. Design basis tornado parameters should be based on Regulatory Guide 1.76 (Ref. 8).
4. Operating basis wind velocity (fastest mile of wind) should be based on the standard published by the American National Standards Institute (ANSI) (Ref. 9), with suitable corrections for local conditions (Ref. 10).
5. The ultimate heat sink meteorological data, as stated in Regulatory Guide 1.27 (Ref. 11), should be based on long-period regional records which represent site conditions.
6. Freezing rain estimates should be based on representative NWS station data.
7. High air pollution potential information should be based on U.S. Environmental Protection Agency (EPA) studies (Refs. 12, 13).
8. All other meteorological and air quality data used for safety-related plant design and operating bases should be documented and substantiated.

### III. REVIEW PROCEDURES

#### 1. General Climate

The general climatic description of the region in which the site is located is reviewed for completeness and authenticity. Climatic parameters such as air masses, general airflow, pressure patterns, frontal systems, and temperature and humidity conditions reported by the applicant are checked against standard references (Refs. 4 and 5) for appropriateness with respect to location and period of record.

The applicant's description of the role of synoptic-scale atmospheric processes on local (site) meteorological conditions is checked against the descriptions provided in References 5 and 6.

## 2. Regional Meteorological Averages and Extremes

Since meteorological averages and extremes can only be obtained from stations in the region of the site which have long periods of record, and the stations are not usually very close to the site, a determination of the representativeness of the data to site conditions is the primary concern in the review. A determination of the adequacy of the stations and their data is also made.

Recorded meteorological averages and extremes are checked against standard publications such as Reference 6. Snow and ice load adequacy is checked for reasonableness against ANSI A58.1-1972-1982 (Ref. 9) and regional data available in References 5, 6, and 7. References 5 and 6 provide information on other averages and extremes. References 12 and 13 provide information on high air pollution potential for verification. Extreme winds and the specific vertical velocity distribution are checked against References 9 and 10. Gust factors are checked against Reference 9. The design basis tornado parameters are checked for agreement with Regulatory Guide 1.76 (Ref. 8) and tornado data are verified using the procedures and data in WASH-1300 (Ref. 14).

The reviewer provides the findings on meteorological parameters to the ~~Structural~~ **Mechanical and Civil** Engineering Branch and other branches as necessary for review of the adequacy of the design of structures, systems, and components important to safety.

## IV. EVALUATION FINDINGS

The reviewer verifies that sufficient information has been provided and that ~~his~~ **the staff's** evaluation supports concluding statements of the following type to be included in the staff's safety evaluation report:

**As set forth above, the** ~~The~~ staff has reviewed available information relative to the regional meteorological conditions of importance to the safe design and siting of ~~this~~ **a nuclear power plant of type specified by the** applicant that might be constructed on the proposed site.

~~The staff concludes that the identification and consideration of the meteorological characteristics at the site and in the surrounding area are acceptable and meet the requirements of 10 CFR Part 100, §100.10(c)(2) with respect to determining the acceptability of the site. This conclusion is based on the presentation and substantiation of~~ **The applicant has presented and substantiated** the meteorological information in accordance with acceptable standard practice as promulgated by the National Oceanic and Atmospheric Administration and in industry standards identified in the references hereto, and **the application** includes the ultimate heat sink meteorological data as stated in Regulatory Position 1-b of Regulatory Guide 1.27 (Ref. 11). **Therefore, the staff concludes that the identification and consideration of the meteorological characteristics at the site and in the surrounding area are acceptable and meet the requirements of 10 CFR 100.20(c) and 10 CFR 100.21(d) with respect to determining the acceptability of the site.**

~~The staff concludes that the identification and consideration by the applicant of the severe regional weather phenomena at the site and the surrounding area are acceptable and meet the requirement of 10 CFR Part 50, Appendix A, General Design Criterion 2, "Design Bases for Protection Against Natural Phenomena," with respect to establishing the design bases for structures, systems, and components important to safety. This conclusion is based on the presentation and substantiation of~~ **The applicant has presented and substantiated** the severe regional weather phenomena in accordance with acceptable standard practice as promulgated by the National Oceanic and Atmospheric Administration and in industry standards identified in the references hereto. **Therefore, the staff concludes that the identification and consideration by the applicant of the severe regional weather phenomena at the site and the surrounding area are acceptable and meet the requirement of 10 CFR Part 50, Appendix A, General Design Criterion 2, "Design Bases for Protection Against Natural Phenomena," with respect to establishing the design bases for structures, systems, and components important to safety.**

The applicant has conformed with the position set forth in Regulatory Guide 1.76. Therefore, the staff concludes that the identification and consideration of tornadoes are acceptable and meet the requirements of 10 CFR Part 50, Appendix A, General Design Criterion 4, "Environmental and Missile Dynamic Effects Design Bases," with respect to determining the design basis tornado for the generation of missiles. ~~This conclusion is based on the applicant's conformance with the position set forth in Regulatory Guide 1.76 (Ref. 8).~~

~~This statement~~ These statements should be preceded by a resume of the general climate and the meteorological design parameters used for the plant.

## V. IMPLEMENTATION

The following is intended to provide guidance to applicants and licensees regarding the NRC staff's plans for using this SRP section.

This SRP section will be used by the staff when performing safety evaluations of early site permit applications submitted by applicants pursuant to 10 CFR Part 52. Except in those cases in which the applicant proposes an acceptable alternative method for complying with specified portions of the Commission's regulations, the method described herein will be used by the staff in its evaluation of conformance with Commission regulations.

Implementation schedules for conformance to parts of the method discussed herein are contained in the referenced regulatory guides.

## VI. REFERENCES

1. 10 CFR Part 50, Appendix A, General Design Criterion 2, "Design Bases for Protection Against Natural Phenomena."
2. 10 CFR Part 50, Appendix A, General Design Criterion 4, "Environmental and Missile Dynamic Effects Design Bases."
3. 10 CFR Part 100, Section 100.10(c)-(2) 20(c) and §100.21(d).

4. U.S. Department of Commerce, "Climate Atlas of the United States," ~~Environmental Data Service~~ **National Climatic Data Center**, NOAA, ~~June 1968~~. **CD-ROM**.
5. U.S. Department of Commerce, "Local Climatological Data - Annual Summary with Comparative Data," ~~Environmental Data Service~~ **National Climatic Data Center**, NOAA, published annually for all first-order NWS stations.
6. U.S. Department of Commerce. "State Climatological Summary," ~~Environmental Data Service~~ **National Climatic Data Center**, NOAA, published annually by State.
7. U.S. Department of Commerce. "Storm Data." ~~Environmental Data Service~~ **National Climatic Data Center**, NOAA, published monthly.
8. Regulatory Guide 1.76, "Design Basis Tornado for Nuclear Power Plants."
9. ANSI A58.1, "**American National Standard: Building Code Requirements for Minimum Design Loads in for** Buildings and Other Structures," American National Standards Institute (198272).
10. H. C. S. Thom, "New Distribution of Extreme Winds in the United States," Journal of the Structural Division, Proceedings of the American Society of Civil Engineers, pp. 1787-1801, July 1968.
11. Regulatory Guide 1.27, "Ultimate Heat Sink for Nuclear Power Plants."
12. G. C. Holzworth, "Mixing Heights, Wind Speeds, and Potential for Urban Air Pollution Throughout the Contiguous United States," AP-101, Office of Air Programs, USEPA, January 1972.
13. J. Korshover, "Climatology of Stagnating Anticyclones East of the Rocky Mountains, 1936-1970," Publication No. 99-AP-34, Public Health Service, October 1971.



14. E. H. Markee, Jr., et al., "Technical Basis for Interim Regional Tornado Criteria," WASH-1300, USAEC, May 1974.